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ABSTRACT

The benefit-cost relationship analysis concerns the cost effectiveness of employment and training in the Water Distribution Division of the Dallas Water Utilities Department and deals specifically with 104 entry workers hired to become pipe fitters. Half of the entry workers were enrolled in the Public Service Careers (PSC) training program and the other half received no formal training. Employee cost, employee proficiency, and personnel turnover were examined for each group. Data indicate that although the PSC trained employees incurred a cost of $200 per month of training, they reached full proficiency at 13 months; the non-trained employees reached proficiency at 21 months. One out of 10.4 non-trained employees stayed; the 47 that quit terminated work after an average of 7.4 months. Half of the PSC trained employees stayed; those that quit did so after 12.9 months. Comparing the training costs involved in filling a job with trained versus untrained employees, the savings experienced from an investment in formal training is $12,633 per job, thus verifying the cost-effectiveness of training. (Tables and figures supplement the text.) (LH)

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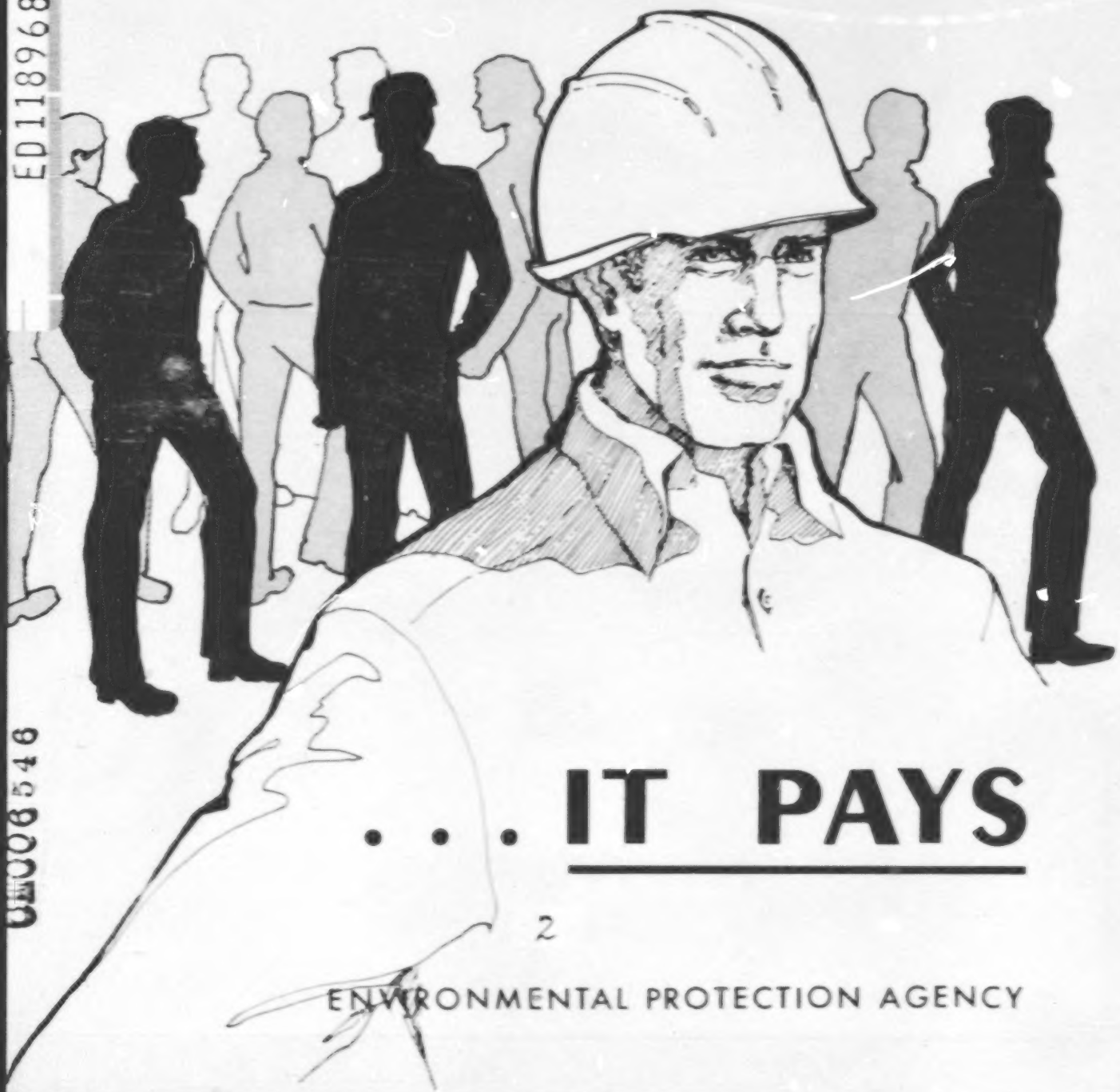

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ENVIRONMENTAL PROTECTION AGENCY

THE BENEFIT-COST RELATIONSHIP IN ENTRY JOB TRAINING IN WATER DISTRIBUTION

• • • • •

by J. P. (Jim) Reames
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for the

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Washington, D. C. 20460

September 1973

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This report has been reviewed by the Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ACKNOWLEDGMENTS

The Environmental Protection Agency wishes to acknowledge and thank Mr. Jim Reames for his major contribution in making this publication possible. The EPA also acknowledges the cooperation of the City of Dallas, the Texas Employment Commission, and the North Central Texas Council of Governments in making essential data and information available.

While the material in this document is directly applicable only to water distribution operations in Dallas, Texas, it should be of much help to persons and organizations at work in fields such as water plant operation, wastewater collection and treatment plant operation, and solid waste disposal. The basic analytical principles and procedures have usefulness in any manpower development situation. There should be application, therefore, in the greater variety of occupations prevailing in the operation of public units and organizations throughout the United States.

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Preface

This analysis of the benefit-cost relationship in entry job training was prepared by the manager of a Water Distribution Division. In particular, his analysis reveals the solid and desirable effects that training has on the retention of workers in jobs. The employment and training of workers, and the long-term retention of those workers, results in a favorable benefit-cost ratio for the manpower development process.

This analysis was developed within the context of a relatively extensive program of public service careers employment and training. That program was conducted by the North Central Texas Council of Governments between November, 1970 and August, 1973. The NCTCOG, headquartered in the City of Arlington, provided training for 608 people drawn from more than 20 cities. Both entry and upgrade training were provided in five fields of work and in numerous job classifications.

The components of the PSC entry job employment and training program are concisely stated here, substantially in functional sequence.

1. People from the unemployed or underemployed ranks of labor were hired with the intent that they be immediately enrolled in the PSC training.
2. Forty hours of orientation to the employment and training program were given to the new hires in a concentrated one-week pattern.
3. The trainees were provided with support services consisting of medical, dental, and transportation assistance.
4. The trainees were subjected to individual and group instruction covering: (a) remedial, basic, and general education; (b) job-related training; and (c) specific job-skill preparatory training. This was accomplished in one day per week over 20 weeks.
5. The trainees were given special counseling and job coaching throughout the 21 weeks of initial employment and training.
6. The trainees were in supervised job activities at various worksites for four days of each week.
7. The total program of employment and training culminated in graduation exercises with the granting of certificates of completion and other awards.

These components of employment and training were built into a schedule that permitted Dallas and other cities in North Central Texas to enroll people without upsetting the work patterns and day-to-day operations of essential public service units.

The analysis material in this report was drawn from only one operational unit and is illustrative of only the pipe fitter job classification. Yet, the information is so pertinent that it should be of much interest to various units of government, professional associations, and other agencies that are supporting job training and career development. It should be of special interest to management in environmental control fields such as water, wastewater, and solid waste disposal.

The North Central Texas Council of Governments recognizes and thanks Jim Reames for the special effort he made in putting this report together. His work on the report is indicative of the high-level professional approach that he has demonstrated as the Chairman of the Public Service Careers Program Operation Advisory Committee.

Marvin Garza
Training Project Director
North Central Texas Council
of Governments

THE BENEFIT-COST RELATIONSHIP IN ENTRY JOB TRAINING IN WATER DISTRIBUTION

Would you believe an $18,769 cost to train one pipe fitter?

This is what the Distribution Division of the Dallas Water Utilities has been paying.

There must be a better way!!!

The concern in this analysis of the benefit-cost relationship is with the cost effectiveness of employment and training as it applies to entry jobs in the Water Distribution Division of the Dallas Water Utilities Department. The data here are from a single operational unit. They do not reflect averages among cities. The data provided specificity and detail about costs that ordinarily are not accumulated in the regular operations of water distribution systems. The data and information were accumulated in this particular case for the purposes only associated with the preparation of this analytical report.

The author recognizes that the statistics may not apply to any other division in the City of Dallas, or any other jurisdiction. It is expected, however, that the methods employed in arriving at the figures would be applicable and the conclusion reached is valid.

Aspects of Employment and Training

A stated intent of the Public Service Careers program was to provide orientation, remedial education, and technical skills training to disadvantaged, unskilled, newly-hired laboring employees. It was an effort to improve and increase their skills and to give them an appreciation of and motivation toward the opportunities open to career public service people.

Statistics on the overall program as well as the segment conducted in Distribution Division prove, beyond a doubt, that PSC has accomplished its goal. Not so obvious, however, is the answer to a frequently asked question – "Was it worth the price?"

Quantification of the Dollar Value

The author has sought for many years to discover a method of accurately quantifying the dollar value of training. The approach utilized in this study developed out of discussions with people representing every aspect of the problem. Those involved included: water utility managers, supervisors, and foremen; personnel directors and training directors, both public and private; management consultants; management and technical instructors; public health officials; and most importantly, the workers themselves, both trained and untrained.

About J. P. (Jim) Reames: He has been in water utility work since 1957. His background of experience makes him eminently qualified to point up the problems and possible solutions. It was his intense interest in good employment and training practices that prompted him to devote much time and effort to development of the material herein.

The most frequent approach to cost effectiveness of a "social program" deals with long-range benefits to the taxpayer and this is, of course, an important aspect. This analysis was made in an effort to establish the here-and-now economic impact of training efforts; the pure dollars and cents answer to the question "What does it cost to train an employee?" The key factor here is the working definition of proficiency. The context is that, "The proficient employee is fully trained and is putting his training into practice."

To further explain or define the term "proficiency", as it is applied in this section, the following elements are indicated:

The proficient worker:

Knows his tools and when to use each of them.

Knows his job in terms of its parts and the sequences in which tasks should be performed.

Is self initiating. He can see what needs doing and does it without being prodded.

Can work independently except when it takes two or more to do the job.

Understands his role in "production" and how quantity and quality standards are met.

Relates well to supervision. In turn, he is helpful to those he supervises.

The proficient worker is the product of both good training and good work experience.

All workers must necessarily receive some form and some quantity of orientation and training. Otherwise, they would be unable to do their jobs. Employers differ widely, however, in their means and methods of providing orientation and training to the work force.

The "Sink or Swim" Tactic

One extreme – and apparently the most common – involves simply letting a new man shift for himself. There is no formal system of training available to him and his foreman neglects helping him over the rough spots. The foreman and supervisors often are not concerned even with learning the man's name. They call him "Hey you!"

This employer may reason that the worker who is "on the ball" will figure it all out for himslef. If he shows sufficient initiative to ask the right questions at the right time, if he studies the technical aspects of the job on his own time, if he "hangs in there" and doesn't become discouraged, then he will probably "make it".

As a result of this situation, many foremen and supervisors are not familiar with even the most basic tools for managing their human resources. As a matter of fact, they may resent the employee who shows initiative and will go to some length to prevent his learning too much about his job and the organization. They see him as a threat to their job security. Therefore, rather than helping to orient and train the new employee, such foremen frequently tend to intentionally retard the trainee's learning process.

Few managers would argue for this "sink or swim" tactic. But it is prevalent in many organizations, simply because management neglects its orientation and training chores.

"All the Way" with Training

The other extreme is a carefully-planned and professionally-executed program of orientation beginning on the worker's first day on the payroll and covering all phases of the company's business. He is shown the various opportunities for advancement and what steps he must take to achieve them. His foreman knows and uses his name. He is shown and made to feel that he is important as an individual. To back this up, there is an equally well-planned and professionally-executed program of training geared to help each individual employee develop his job skills, improve his promotability, and increase his earnings.

A surprising number of managers will argue against going "all the way" with orientation and training. Their major point concerns the expense of formal training. The data and information that follows will hopefully resolve that argument.

Perspective of This Analysis

This analysis deals specifically with 104 employees who were hired between mid 1970 and early 1972. Fifty-two of these people were enrolled in the PSC Training Program. Seven terminated prior to completion and 45 graduated. Each of the trainees cost the federal taxpayer $1,198.40 (approximately $200.00 per month) and cost the Water Distribution Division wages for one day per week off the job for classroom training.

The other 52 received no formal training. They were, in effect, allowed to sink or swim. There was no direct cost to the federal taxpayer or to the City for training these people, or was there?

Each of the 104 employees was hired as a Laborer. No skills or previous experience are required to become a Laborer. It is not the intent, however, of the Water Distribution Division to hire career laborers. Every new employee is actually in training from his first day on the job to become a Pipe Fitter. Substantial skills must be mastered prior to the employee's reaching 100 percent proficiency as a pipe fitter.

This study addresses three separate, but closely related aspects of employment and training: (1) employee cost, (2) employee proficiency, and (3) personnel turnover.

Total Employee Cost

The total cost of an employee is obviously much more than his salary alone. The various major ways that the City of Dallas supports each employee monetarily are:

Cost Items	Percent of Salary
Salary: $381.00 per month for beginning laborer to $523.00 per month for pipe fitter.	100.00
Benefits: Vacation, sick leave, retirement, life insurance, health and accident insurance, jury duty leave, military duty leave, death in family leave, and others.	20.47
Administrative: Personnel and civil service departmental costs, payroll and clerical costs, paycheck preparation and processing, and 15 percent of administrative and managerial salaries.	5.61
Training: Total training budget for seminars, short schools, etc.	0.54
Total	126.62

Regardless of how such costs vary among cities over the country, they remain substantial in all cities.

Employee Proficiency Data

The data on employee proficiency were derived from more than one hundred exhaustive interviews with Water Distribution Division supervisors, foremen, and workers who had personal contact with the people in the two study groups.

The major purpose of the interviews was to ascertain the relative proficiency of the average employee in each of the two groups at various points in time. The foremen and supervisors discussed the question, "When do you consider that an employee is earning his pay?" They were questioned about their specific experiences with fast learners, slow starters, and various other categories of new employees who did not receive any formal training. They were asked to comment in detail on the performance, proficiency, attitudes, and productivity of the PSC trainees with whom they had direct contact, and to compare them with various untrained employees with similar backgrounds prior to employment.

The author sought diligently and objectively to sort and interpret the interview data and presents what he sincerely believes to be true averages. The indicators are that:

1. The training method in use by the Water Distribution Division prior to the PSC program was "sink or swim" as described above with two exceptions.

    a. There did exist an orientation program conducted on a City-wide Basis which was not judged to have any visible effect on the employees who attended.

    b. A few (less than 25 percent) of the supervisors and foremen had attended short courses on supervision which helped them recognize and appreciate the advantages of having well-trained workmen under their supervision.

2. Although each individual employee approaches proficiency at a different overall rate and at different rates during the training period, the mean rate is a straight line.

3. The average time required for a sink or swim trainee to reach proficiency is 21 months.

4. Although the PSC trainee is off the job one day per week during the six-month PSC period, his proficiency level rises at a straight rate through this period and beyond.

5. The average time required for a PSC trainee to reach full proficiency is 13 months.

6. The average beginning laborer employee without prior experience is worth no more than $200.00 per month on his first day on the job.

Salary Information

All labor employees receive longevity salary increases at 3 months, 6 months, and 5 years. In addition to this, the supervisor is permitted to recommend three raises based on "merit".

The average employee in the sink or swim group received his discretionary merit raises at 9 months, 18 months, and will possibly receive the third at 36 months.

The average PSC trainee received his discretionary merit raises at 4 months, 10 months, and 18 months.

Comparative Employment and Training Costs

The tables on the next two pages summarize the Comparative Cost data for the two groups of workers. In Table I the costs are shown for the Sink or Swim Employee in terms of salary only, since he received no special training. Table II reflects the total cost of the PSC Employee, including the cost of his training. In Table II, the data are in a 21-month time frame to make them comparable to the data in Table I.

As mentioned earlier, proficiency is the key factor. An employee is actually in training until he reaches proficiency as a worker. The training cost is, therefore, the portion of the total employee cost that he did not actually earn.

Figure 1 graphically illustrates the relationship between earnings and training cost for an average sink or swim trainee. The total cost of the employee over the 21-month period from Table I is $11,649. The area below his "proficiency line" represents his worth which amounts to $8,694, or 74.6 percent of his total cost. The difference between total cost and earnings is the cost of training the employee which is $2,955, or 25.4 percent of total cost.

TABLE I

SINK OR SWIM EMPLOYEE COST

Time Employed (months)	Salary x 1.2662 (per mo.)	+	Training Cost (per mo.)	=	Total Cost (per mo.)	x	Interval (months)	=	Total Cost
0	$482		0		$482		3		$ 1,446
3	507		0		507		3		1,521
6	532		0		532		3		1,596
9	578		0		578		9		5,202
18	628		0		628		3		1,884
21	Proficiency								$11,649

TABLE II

PSC EMPLOYEE COST

Time Employed (months)		Salary 1.2662 (per mo.)	+	PSC Cost (per mo.)	=	Total Cost (per mo.)	x	Inte val (months)	=	Total Cost
0										
		$482		$200		$682		3		$ 2,046
3										
		507		200		707		1		707
4										
		551		200		751		2		1,502
6										
		578		0		578		4		2,312
10										
		628		0		628		3		1,884
13		Proficiency								$ 8,451
		628		0		628		5		3,140
18										
		663		0		663		3		1,989
21										$ 5,129
	Total									$13,580

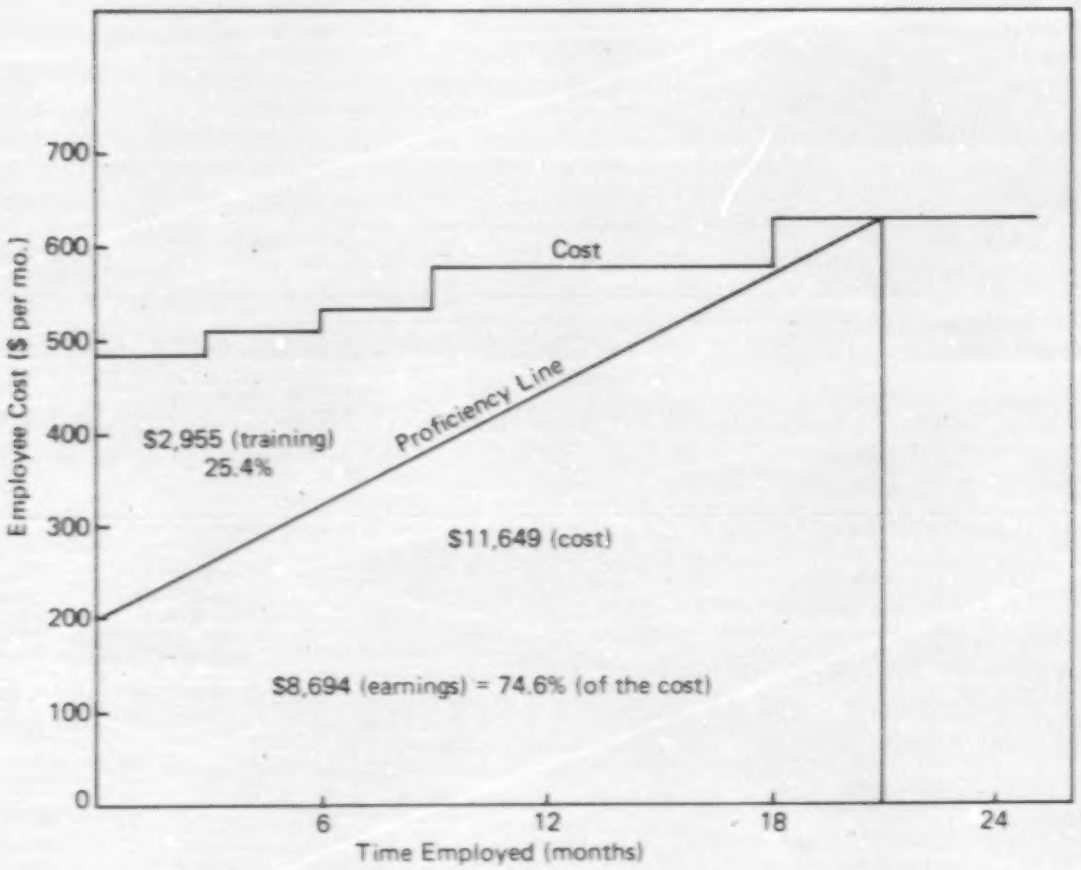

Figure 1 – Cost-Proficiency – with sink or swim approach

Figure 2 is a graphical illustration of an average PSC trainee. His total cost over a 21-month period is $13,580, almost $2,000 more than the sink or swim employee. His earnings, however, equalled his cost from the 13th month on. This man earned $10,511, or 77.4 percent of his total cost. The training cost, including $1,200 federal government expenditure, is $3,069, or 22.6 percent of total cost.

Comparing the two sets of data, the $114 additional training cost for the PSC trainee yielded $1,817 in additional value to the employer!

Training and Job Retention

The length of time it takes to train an employee and the cost of doing so are two important factors. Retention on the job is, however, the critical factor. The training investment in an employee is completely sacrificed when he quits.

Payroll records indicate that only five men out of the control group of 52 "sink or swim" trainees are still working in the Water Distribution Division. One out of 10.4 stayed. It is necessary, therefore, to train 9.4 people, and wave good-bye to them, before we find one who will stick with us. This repetitive training of 10.4 people to obtain one proficient employee is shown in Figure 3.

On the other hand, 26, exactly half of the PSC trainees, are still on the payroll. Obviously, the training had a very significant effect on retention. With training, it appears necessary to train only one "quitter" as we find another employee who stays with us.

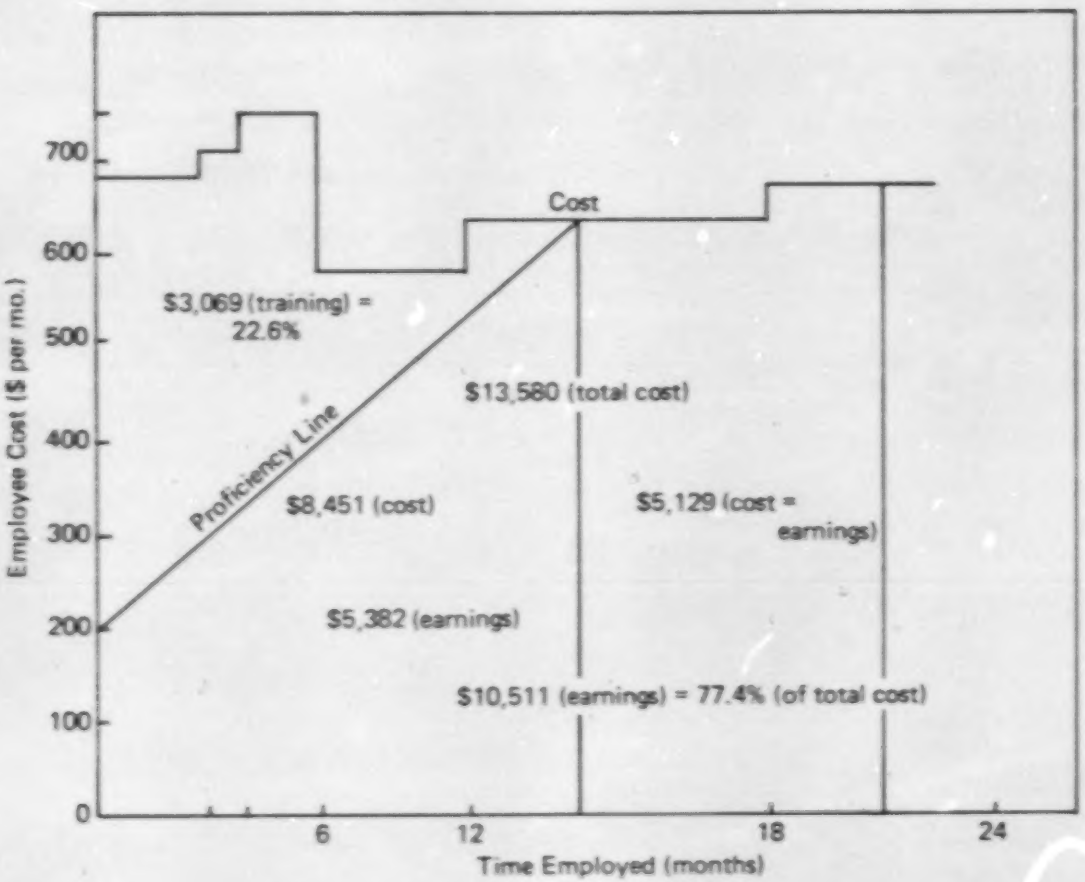

Figure 2 – Cost-Proficiency – with PSC training

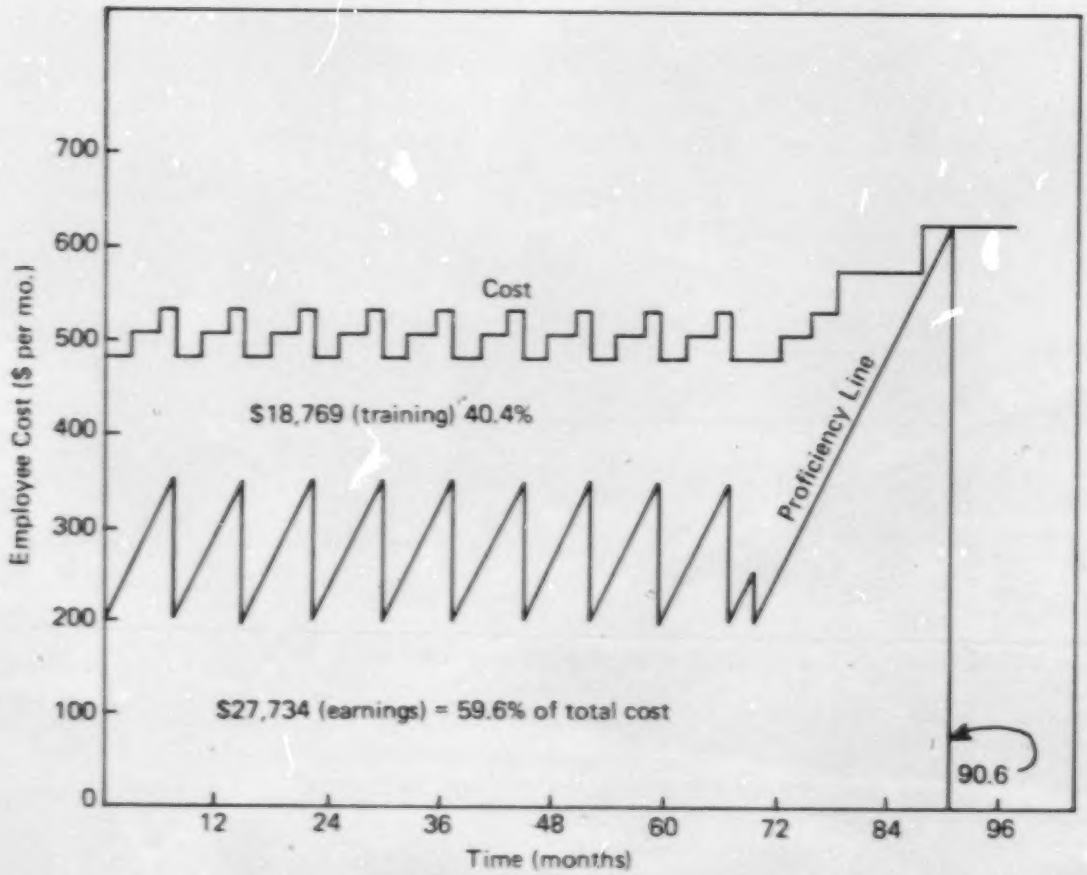

Figure 3 – Cost to Fill a Position with Sink or Swim Approach

Further analysis of payroll records reveals that the 47 control employees who terminated worked an average of 7.4 months. In sharp contrast, the average tenure of the 26 trained employees who quit was 12.9 months. This points up another significant effect of the PSC training.

Figure 3 also combines the previously presented data with the turnover and tenure data and presents a graphical illustration of the costs incurred in filling a position with an employee trained by the sink or swim method. Salary, benefits, administrative costs, and training (such as it is) totals $46,503 over a 90.6-month period. Eighteen thousand seven hundred sixty-nine dollars, or 40.4 percent, of this cost is invested in training. The yield on this investment is $27,734 in earnings.

Figure 4 illustrates the turnover and tenure plus cost and proficiency data on the average position filled by a PSC trainee over the same 90.6-month period used in Figure 3 for a sink or swim employee. In the case of the PSC trainee, it takes only 25.9 months to fill the position with a trained man, and from that point on he is fully earning his pay. The total cost is $59,862 over the 90.6-month period including the PSC costs and a higher salary toward the end (5-year longevity raise). The training cost is $6,136, or 10.2 percent of the total cost.

Conclusion

Comparing the training costs involved in filling a job with trained versus untrained employees, the savings experienced from an investment in formal training is $12,633 per job. This provides back-up for the statement that hangs on the author's wall:

Training Water Utility Employees

Doesn't Cost – It Pays!

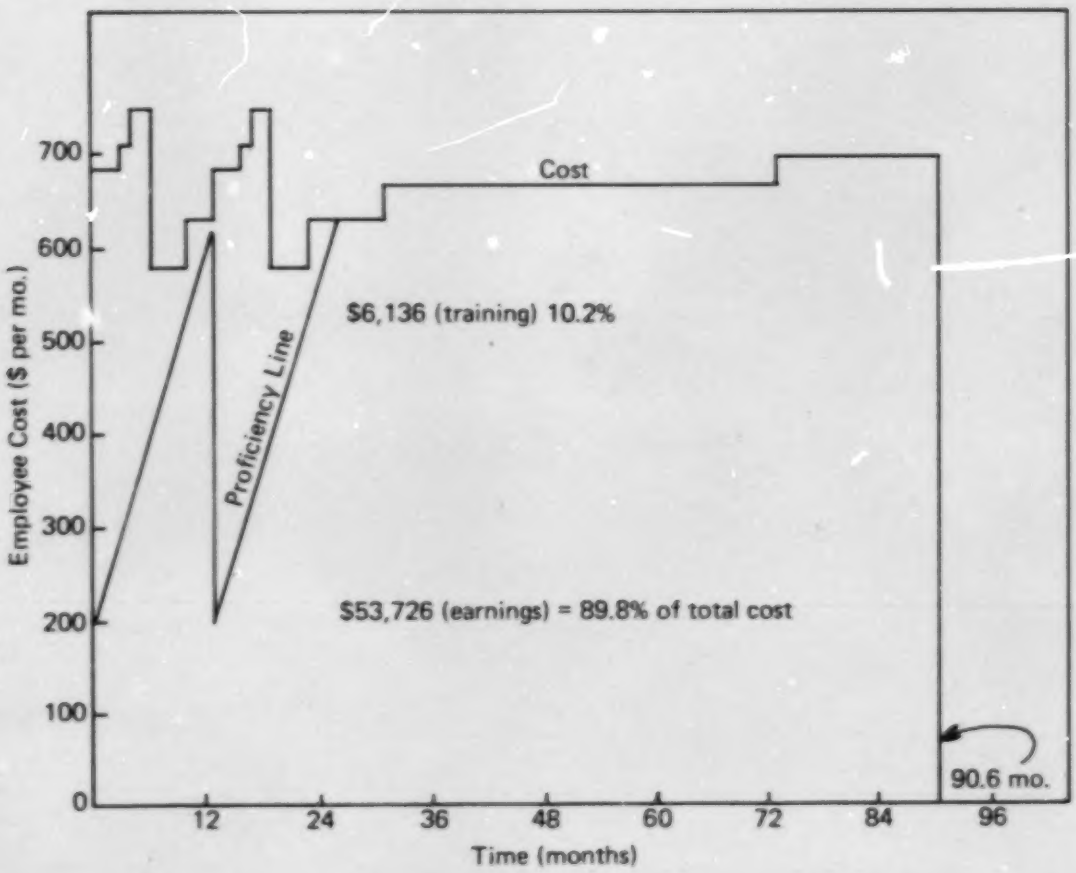

Figure 4 – Cost to Fill a Position With PSC Training